SuperTruck

VOLVO

Pascal Amar (PI / Presenter)

Volvo Technology of America

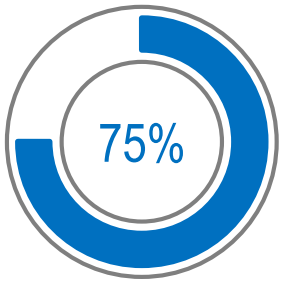
Project ID: VSS081

June 11th, 2015

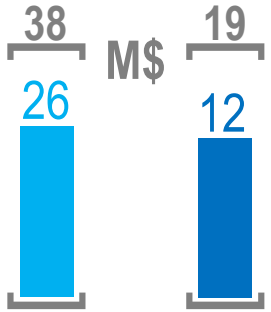
Project Overview

VOLVO

Grote RIDGE PENNSTATE FREIGHT WING

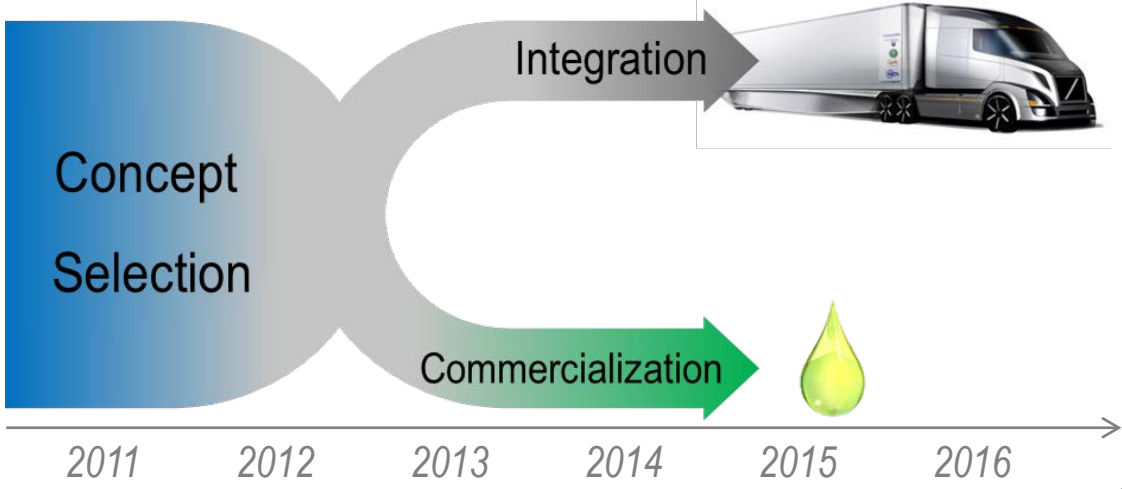


Project Status



Vehicle Project Partners

Metalsa
ExxonMobil
Bergstrom
ArvinMeritor
MICHELIN
ALCOA
HENDRICKSON



Objectives / Barriers / Relevance

Vehicle Project Objective: **50% more ton-miles per gallon** than a 'best in class' 2009 truck

Reporting Period Objectives	Barriers
Integrate selected concepts in demonstrator	Timely evaluation of complex technologies
Apply lessons learned to current products	Rapid development of promising technologies
Fully develop aero concepts from Phase I	Operational effectiveness of advanced aero devices
Bring improvements to market	Cost of technology and Customer ROI

In support of *more energy efficient & environmentally friendly highway transportation*

Recap: Concept Selection Results

Baseline

2009 VNL 670

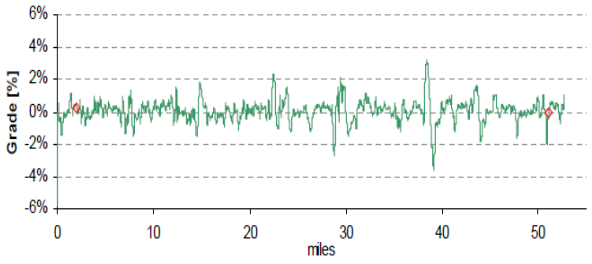
D13 485HP 1,650lb-ft

Test Conditions

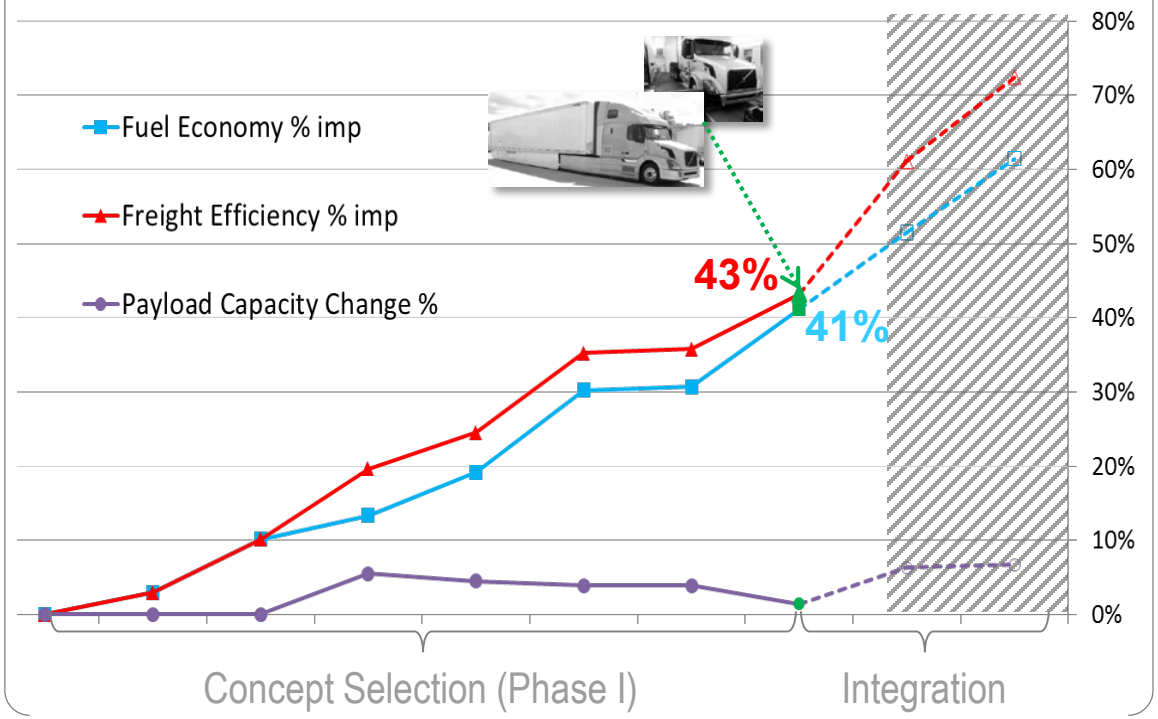
All tests run North & Southbound

65mph, no stops / no accelerations

Only representative runs averaged



Achievements from last AMR



Approach: Technology Content

Fuel Savings

40% aerodynamic drag reduction
20% lower rolling resistance
50% BTE powertrain
'look-ahead' energy management
intelligent auxiliary control
kinetic energy recovery
driver coaching

Freight Efficiency Target

Weight Savings

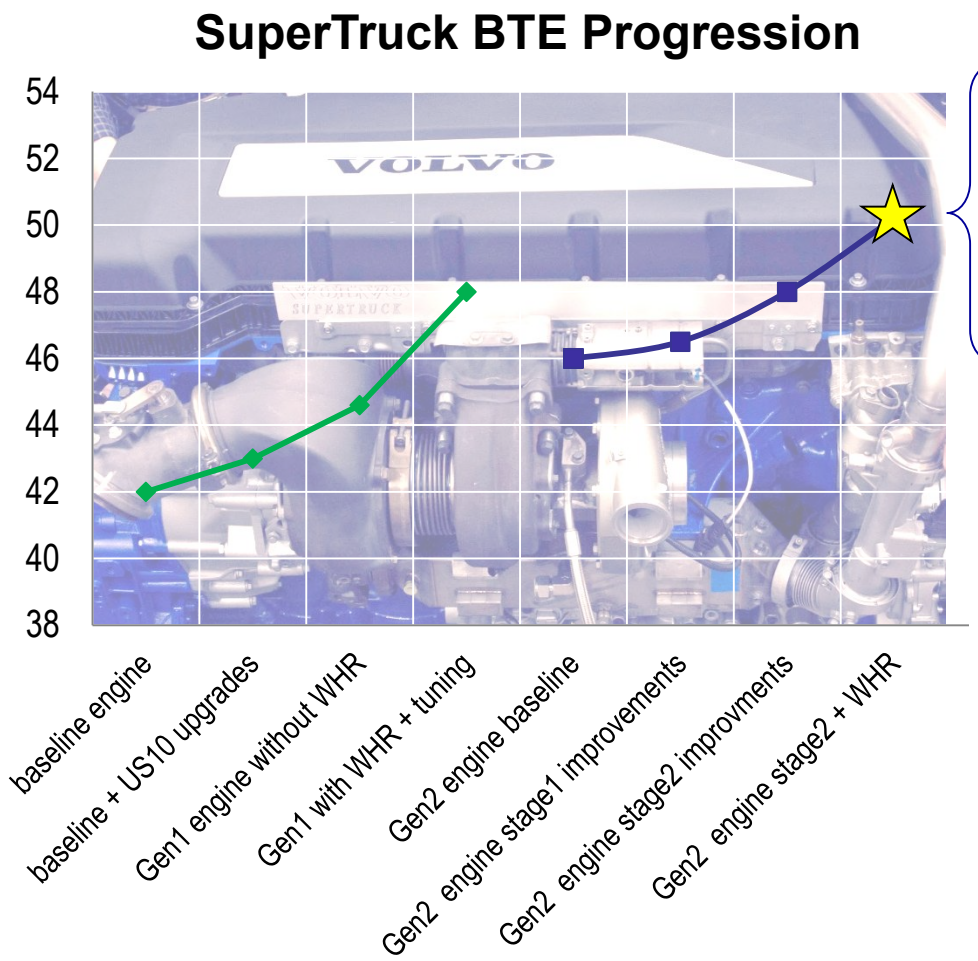
40% lighter chassis
engine downsizing
composite aero fairings
6x2 axle & wide base tires
Light trailer suspension & slider box
light gauge wire harness

Measured on 24-hr duty cycle

electric HVAC system
improved cab insulation
LED lighting in & out
integrated solar power

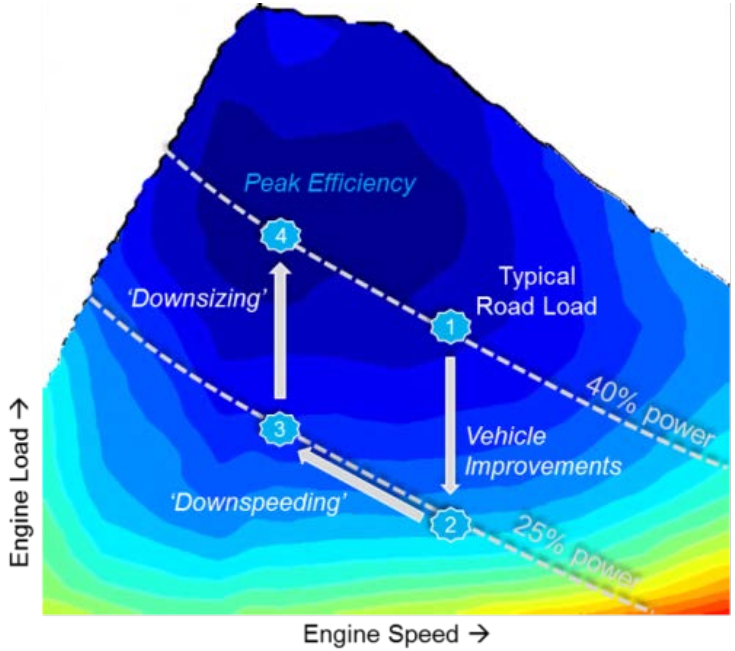
Hotel Loads

Achievements: Powertrain Improvements



50% BTE component development complete

System integration and test is ongoing



Achievement: Demonstrator Build Progress

Technology integration on track to begin fuel economy testing in 2015

Approach: Commercialization of Trailer Aero

Design & Optimize in CFD

Verify fuel economy impact on-road

Test prototypes in wind tunnel

Re-engineer for real world operation

operational fleet testing

Verify durability in shaker test

Re-engineer for improved durability

Wind tunnel verification for EPA certification

Secure manufacturing capability

Promote & launch

Achievement: Technology Transfer

Concept Selection

8 aero configurations

500,000 CPU hours

2,000 miles road tests

11 design iterations

70 hours in wind tunnel

70 test units in **14** fleets

150,000 CPU hours

300,000 miles shaker test

1,080 miles track testing

3,500,000 miles field test

Integration

Commercialization

Achievement: New Tail Product Launched!

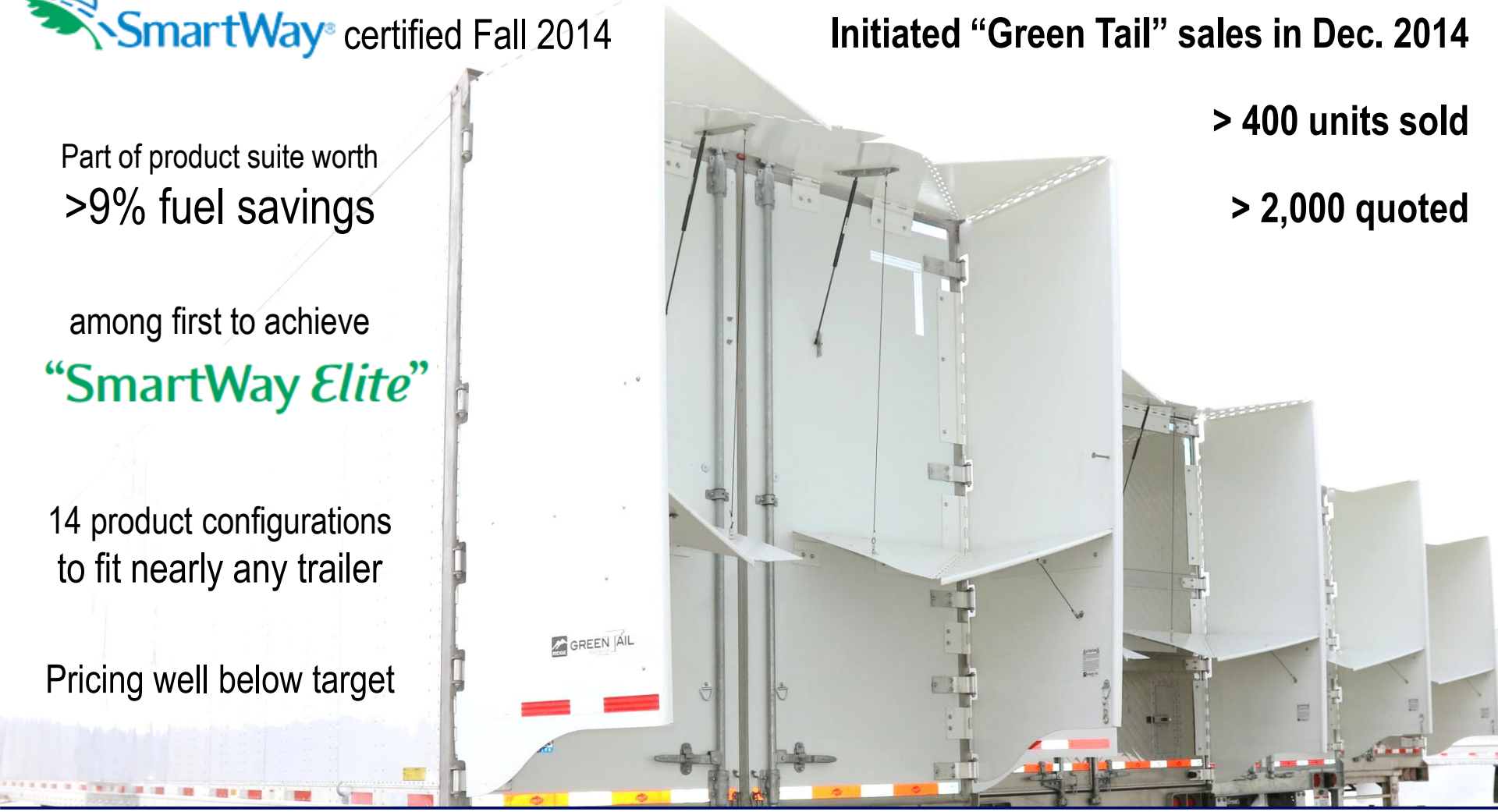
SmartWay® certified Fall 2014

Part of product suite worth
>9% fuel savings

among first to achieve
"SmartWay *Elite*"

14 product configurations
to fit nearly any trailer

Pricing well below target

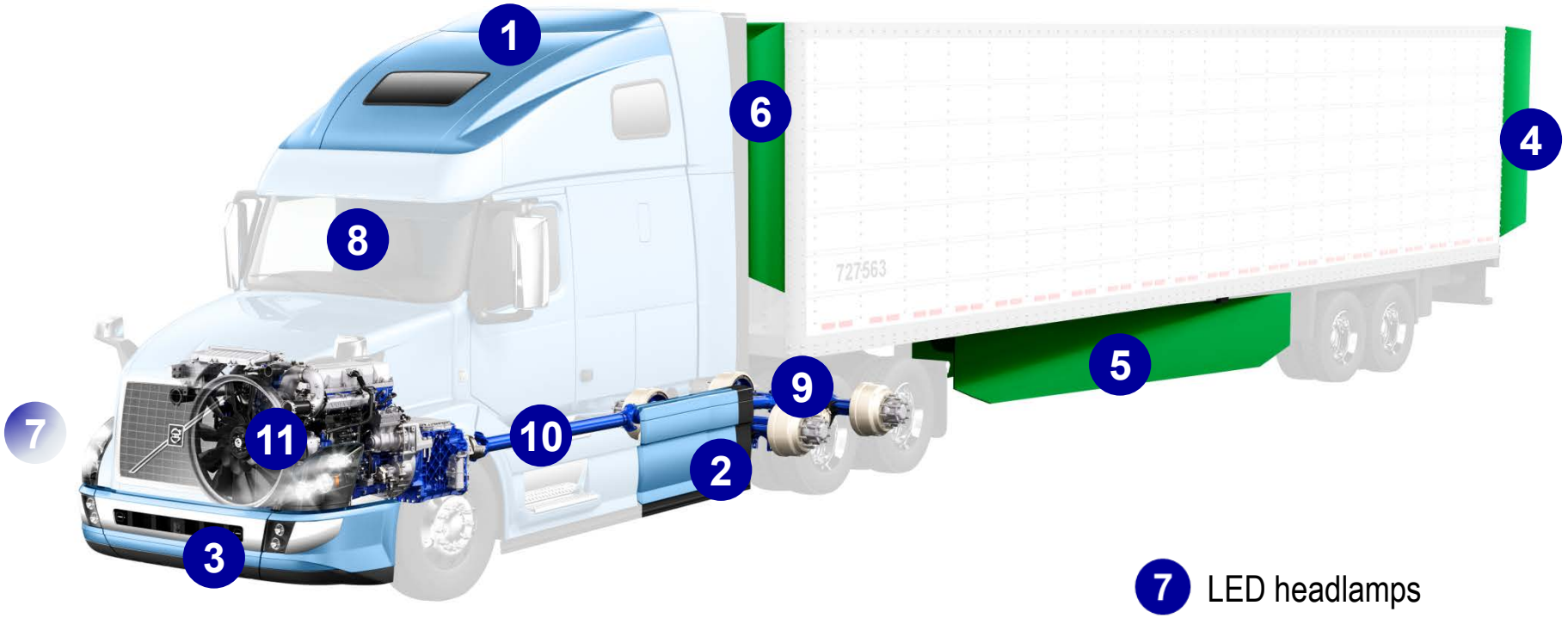


Initiated "Green Tail" sales in Dec. 2014

> 400 units sold

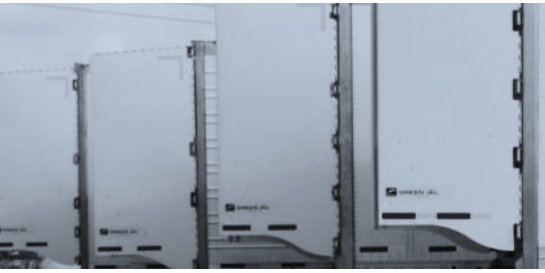
> 2,000 quoted

Achievement: Inspired by SuperTruck



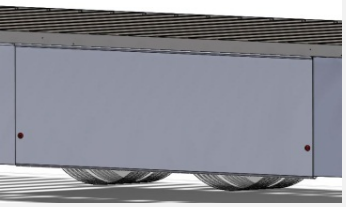
1. Improved roof fairing
2. Flared chassis fairing
3. Aero optimized bumper
4. Optimized tail fairing
5. Optimized trailer skirt
6. Optimized gap fairing
7. LED headlamps
8. LED interior lighting
9. 6x2 axle configuration
10. Aluminum Propshaft
11. Reduced Parasitics

Next Steps: Trailer Aerodynamics

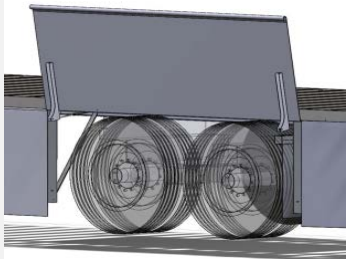


Continue roll-out & demonstration of tail fairing
to **obtain OEM factory installation clearance**

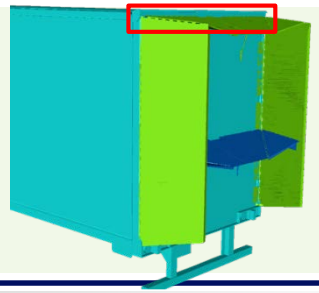
Implement laminated LED marker / turn signal to
reduce or eliminate associated drag

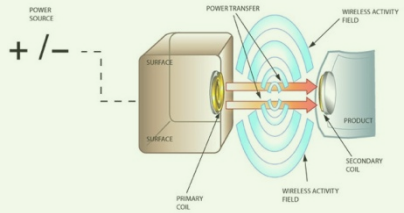


Develop operationally practical
extended / full length skirt fairings
and initiate fleet testing



Develop solutions to allow tail fairing
installation in **most aerodynamic position**





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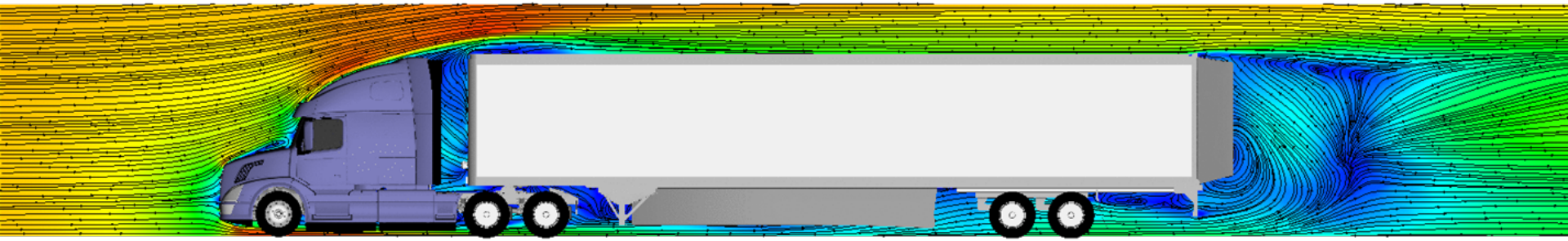
Next Steps (cont.)

Integrate technologies in demonstrator

Start on-road fuel economy testing



Commercialize Supertuck-inspired trailer aerodynamics product suite

(skirt, gap and tail) offering 12% to 14% fuel savings by project end

Summary: Reporting Period Objectives

Accomplishments at 75% Project completion

Demonstrator build on track for 1st fuel economy tests in 2015

Developed & commercialized practical trailer aerodynamic devices

Commercialized tractor aero improvements based on Phase I learnings

Relevant Research

This material is based upon work supported by

- DOE & NETL under Award Number DE-EE0004232
- DOE & NETL under Award Number DE-FC26-07NT43222
- DOE Project ID VSS006, Reduce Truck Aerodynamic Drag w/ LLNL
- DOE Project ID VSS022, CoolCab – Reduce Thermal Load w/ NREL

TECHNICAL BACK-UP SLIDES

Partners & key Collaborations

Organization	Key Contribution
Volvo Technology of America	Project lead & concept simulations
Volvo Group Truck Technology	Complete vehicle integration & vehicle testing
Volvo Group Powertrain Engineering	Efficient complete powertrain solutions
Ridge/Freight Wing	Advanced aerodynamic devices for trailers
Grote	Advanced lighting systems
Penn State University	Advanced combustion modeling & simulation
Hendrickson	Lightweight trailer axle & suspension components
ExxonMobil	Advanced fuels & lubricants
Alcoa Wheels	Lightweight wheels
Michelin	Advanced low-friction tires
Metalsa	Ultra-Light Frame Assembly

List of Acronyms and Abbreviations

BTE	Brake Thermal Efficiency
CFD	Computational Fluid Dynamics
DOE	Department of Energy
NETL	National Energy Technology Laboratory
MY	Model Year
Nm	Newton-meters
rpm	revolutions per minute
WHR	Waste Heat Recovery
$M	Million US Dollars